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Global patterns of national climate policies: Analyzing 171 country portfolios on climate policy integration

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ABSTRACT

Over the last decades, a growing number of countries around the world adopted policies towards climate change. However, apart from the remarkable increase in legislative activity, we know little about the composition of country portfolios on climate policy and whether those rely mainly on specific climate policies or the integration of climate objectives across domains. Research on policy integration is often bound by a dearth of suitable data and has to rely on small-n comparative case study designs or a certain type of policy when investigating these phenomena. Our paper addresses this gap by drawing on the *Climate Change Laws of the World* database for national climate legislation across eight policy categories. Hereby, we systematically assess how climate-related policies have developed over the last 27 years and across 171 countries. The analysis shows that since 1990, the scope of country portfolios has risen considerably. This increase started somewhat slowly in the 1990s but accelerated afterwards across all categories, albeit at different times and to varying degrees of coverage. In particular, climate policies on energy demand and supply as well as administrative arrangements are widespread. Our findings suggest that efforts at CPI were more common in the energy than the transportation domain. The focus of climate specific categories, i.e. no efforts at CPI, were 'administrative arrangements', and, albeit to a much lesser extent, policies addressing carbon pricing. With respect to future climate action, the results of our cross-country analysis are two-fold. On the one hand, it is reasonable to assume that countries not having enacted policies in the most commonly addressed categories will soon follow suit. On the other hand, transportation and carbon pricing, specifically, are policy areas that are least addressed in our sample and represent an area where much is yet to be uncovered.

1. Introduction

Governing the challenges of climate change has been addressed by a multitude of perspectives and approaches. International negotiations have been a focal point of social science research since the early 1990s with a renewed debate due to the successful adoption of the Paris Agreement in 2015 (Rajamani, 2016; Rogelj et al., 2016). In recent years, however, policies addressing climate change at the national level are moving to the center of political attention worldwide (Bernauer and Böhmelt, 2013; Jordan et al., 2015; Lachapelle and Paterson, 2013). Hence, a literature has begun emerging, drawing particular attention to these new patterns of *national* policy activity and focusing on comparative policy and politics globally (Cao et al., 2014; Fankhauser et al., 2015; Lesnikowski et al., 2016; Nachmany et al., 2015; Never and Betz, 2014; Tobin, 2017; Townshend et al., 2013).

The cross-cutting nature of climate change affects many different domains. Therefore, it is vital to coordinate the various efforts (Adelle and Russel, 2013). Scholars of climate policy integration (CPI) investigate whether, how and to what extent climate concerns are integrated into other domains (Adelle et al., 2009; Dupont, 2016; De Roeck et al., 2018). Yet, most studies are restricted to single or small-n case studies (see Jacob et al., 2008 for an exception) leaving little to no possibility to derive generalizable results (Lang and Tosun, 2013). This is, among other reasons, due to the fact that large-n empirical assessments of CPI are often bound by the lack of suitable data (see Dubash et al., 2013 for an overview of databases that track national climate policies). To address this research gap, we investigate portfolios of national climate policy on a global scale. Specifically, we complement existing literature and add to emerging topics and pressing questions in CPI research by assessing different climate policy categories in 171 countries over the last 27 years.

The following research questions guide this study: how has climate-related policy developed over time and across countries? Specifically, do we observe patterns where countries show efforts at CPI? With our analysis, we are not only able to display national climate policy portfolios but also investigate whether countries rely on either specific

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climate policies or CPI when addressing the challenges of climate change.

The remainder of this study is structured as follows. The next segment presents an overview of previous literature on CPI. By discussing key phenomena, we derive the respective hypotheses for answering our research questions. Subsequently, data sources, operationalisation and methods of our empirical analysis are explained. After discussing the results, we conclude by summarising the main findings and indicate avenues for further research.

2. CPI in the context of climate policy

Climate change is a complex, boundary-spanning problem (Jochim and May, 2010), and policies cut through a myriad of domains because they concern adjacent sectors (Van Asselt et al., 2015). Coordination efforts are highly contested when policies originate in various sectors (at times with competing priorities) because it can lead to disputes over accountability among policy actors (Peters, 2015; Tosun and Lang, 2017) whose responsibilities are often distributed over various ministries (Schmidt et al., 2018). This predicament also applies to the environmental policy integration (EPI) literature that proceeded CPI (Jordan and Lenschow, 2010; Mickwitz et al., 2009; Runhaar et al., 2014). Broadly speaking, both strings of literature call for coordinated policy approaches, but the debate around climate targets has, so far, received less attention 'despite its increased prominence in policy circles' (Adelle and Russel, 2013: 2).[1]

Indeed, not only the sheer increase in policy activity over the last decades but also the respective scope and diversity of climate policies are remarkable (Keohane and Victor, 2011). Studies investigate, for example, the adoption patterns of specific climate policies with regards to both mitigation and adaptation (Fleig et al., 2017) or analyze the so-called (Intended) Nationally Determined Contributions [(I)NDCs] formulated by each individual state following negotiations at COP 21 (Tobin et al., 2018).

However, we need to take a more reflective stance beyond a mere confirmation that countries act upon a CPI strategy as envisaged in the literature. For instance, Höhne et al. (2017) find that globally, though especially in developing countries, the process of formulating (I)NDCs has produced an increasing number of climate plans and strategies. Studies find that acting upon broader guiding principles or strategies is indeed more common (Brouwer et al., 2013; Nunan et al., 2012) than having legally binding targets because these softer measures of governance can, in turn, also be adopted more frequently; they do not interfere with sector-related policy-making and/or the existing institutional structure.

Assessing the degree to which climate objectives have been integrated into established policy domains is not an easy task. This is primarily because the literature is not consistent, using CPI synonymously with other, related concepts (Di Gregorio et al., 2017) such as 'mainstreaming' (Kok and De Cornick, 2007; Swart and Raes, 2007), which investigates mainstreaming climate objectives in relation to adaptation (Brouwer et al., 2013; Runhaar et al., 2017). Clearly differentiating CPI from EPI and energy policy integration (EnPI) is challenging (Tosun and Peters, 2018). Yet, it is even more difficult to distinguish CPI from climate policy 'per se' (Adelle and Russel, 2013: 2) when operationalizing it. This is why most CPI scholars focus on one specific policy area such as forests, agriculture, energy or transport (Adelle et al., 2009; Hogl et al., 2016; Stead, 2003), using document analysis and semi-structured interviews (Ahmad, 2012), or case-study design (Kivimaa and Mickwitz et al., 2009) to assess CPI. However, looking at one particular aspect reveals only a piece of the (entire) puzzle and makes it difficult to provide 'historical perspectives' (Persson et al., 2016: 478) in order to better understand how practices evolve over much longer periods of time and across the world.

While in general, little is known about successful implementation of CPI (Persson et al., this issue), disagreement exists with regard to the integration efforts' assessment of output success. Some scholars draw distinct lines between sufficient and insufficient integration (Dupont, 2016; Nilsson and Nilsson, 2005), but others acknowledge that processes move at different paces (Jordan and Halpin, 2006), calling for an output (Abramczyk, 2013) or 'processual' understanding of the matter (Candel and Biesbroek, 2016).

In both cases, CPI as policy output or as policy process, integration of policy goals across scales usually takes place within two dimensions, i.e. vertically across levels of government and horizontally across different sectors (Giessen, 2011a, 2011b). Both are important aspects of the equation, but as we are primarily interested in looking at whether or not categories have been addressed by national climate policies, we focus on *horizontal* integration efforts and conceptualize these 'policy categories' in our subsequent empirical analysis. In analysing the spread of climate policies, we focus on the policy *output* dimension manifested as national level policy. In 'an attempt to bring environmental [or in our case: climate] objectives on equal terms with sectoral objectives' (Persson et al., this issue), we take on the *harmonisation* perspective on integration. This means that instead of looking at one particular domain or at a specific policy instrument, we assess climate policy on mitigation and adaptation and focus on assessing a large sample set of countries over nearly three decades. In doing so, we follow Di Gregorio et al.'s definition of CPI 'as the integration of multiple policy objectives, governance arrangements and policy processes related to climate change mitigation, adaptation and other policy domains' (2017: 36).

Hypotheses

Apart from the remarkable increase in legislative activity over the last decade, we know little about the composition of country portfolios on climate policies. As climate change requires a policy mix 'in a multidimensional and cross-sector manner' (Christopoulos et al., 2012: 308), we argue that the number of categories addressed by national climate policy will increase. Looking at how many categories are addressed, we are able to assess whether countries show a more comprehensive coverage approach. We argue that such a comprehensive approach can serve as a proxy for CPI, in particular when the respective policies address established policy sectors. Importantly, we do not expect such a development to be uniformly distributed across countries. As multiple factors influence individual state responses towards climate change (Christoff and Eckersley, 2011; Tobin, 2017), our analysis further investigates potential determinants such as political conditions, institutional capacity and problem characteristics. By factoring in such variables, we are able to investigate what countries do and assess how much more (or less) they are doing than others.

I) Looking at *political conditions*, we first turn to the member states of the European Union (EU). Early on, the EU installed EPI as a key and extended principle, for example citing it in the Third Environmental Action Programme adopted in 1982 (Geerlings and Stead, 2003). In 1998, the 'Cardiff Process' initiated integration strategies for sectors such as transport, energy and agriculture. Similarly, the EU prominently and repeatedly has claimed a global leadership role in combatting climate change (Gupta and Ringius, 2001; Oberthür and Roche Kelly, 2008), establishing the European Trading Systems (ETS) and the EU's Climate and Energy Package with ambitious targets (European Commission, 2016). As individual member states have been criticized for the gulf between ambition and reality considering the actual implementation of climate policy goals (Fleig et al., 2017; Parker and Karlsson, 2010), we are interested in examining whether EU countries actually do lead the way in terms of passing national climate policies. Here, we expect that the EU's climate change leadership aspiration manifests itself, c. p., in a temporal aspect of enacting climate policy at an earlier point in time (Hypothesis 1a). In addition, we expect EU

[1] The existing literature in both fields can be useful for identifying potential variables. However, there is also a debate between the specific differences of CPI and EPI (Adelle and Russel, 2013).

countries to display climate policies across more policy categories (Hypotheses 1b).

H1a. EU member states act earlier on climate policy.

H1b. EU member states show more CPI.

II) Assessing *institutional capacities*, previous studies highlight the need of financial support from the central government (Measham et al., 2011; Nalau et al., 2015) for acting on climate change as 'larger and wealthier states appear to innovate first' (Volden, 2006: 312). Accordingly, we raise the questions as to when (Hypothesis 2a) and to what extent (Hypothesis 2b) are governments able to pursue policy integration (Persson et al., this issue) by taking into account a country's income level.

H2a. High-income countries act earlier on climate policy.

H2b. High-income countries show more CPI.

III) Examining *problem characteristics*, Lang and Tosun (2013) argue that accountability as well as affectedness matter for policy integration. In this regard, it makes sense that the degree of vulnerability (Adger, 2006; Baettig et al., 2007) is prominently mentioned as a condition driving climate policies (Barnett et al., 2008; Christoff and Eckersley, 2011). We, therefore, investigate whether a country's environmental vulnerability is linked to earlier climate policies (Hypothesis 3a) and is more pronounced across categories (Hypothesis 3b).

H3a. Environmentally vulnerable countries act earlier on climate policy.

H3b. Environmentally vulnerable countries show more CPI.

3. Operationalisation, methods and data

For answering our research questions, we rely on the *Climate Change Laws of the World* database.[2] It is the most reliable and comprehensive dataset on national legislative activities for climate change mitigation, adaptation and litigation (Nachmany et al., 2017), covering 171 countries since 1963 and comprising of information on 1359 pieces of climate legislation (version November 2017). This remarkable amount of data is collected, on the one hand, by using a rather broad definition of the term 'legislation' because the database also includes 'regulations, policies and decrees with a comparable status […] to ensure the best reflection of the overall legislative and regulatory response to climate change' (ibid: 21f). On the other hand, general environmental laws and policies are only included when comprising of an explicit climate change focus. Even more important for our research interest, the data contains for each entry its specific allocation towards the following eight categories: adaptation, carbon pricing, energy demand, energy supply, institutions/administrative arrangements,[3] REDD + and LULUCF, research and development (R&D), and transportation. This classification only partly corresponds with established policy sectors: both 'energy' categories relate to climate policy for the energy sector, 'REDD + and LULUCF' to the forestry and land-use sector, 'R&D' to the 'R&D' sector, and 'transportation' to the 'transport' sector. 'Adaptation' likely addresses multiple sectors, leaving 'carbon pricing' and 'administrative arrangements' as two specific climate categories which do not mirror efforts at CPI. Despite this, we stick with the original categorization for reasons of transparency.

While we use this content-related information on targeted categories, please note that our approach is purely enumerative as any qualitative measures are not considered. However, simply counting the amount of national policies is likely to produce measurement errors (Grant and Kelley, 2008). Others have addressed this issue by looking at the content of laws and policies (Adam et al., 2017) or by constructing an index (Schaffrin et al., 2014). In contrast, we follow Christoff and Eckersley (2011) by focusing on potential emerging patterns in policy activity per category and capture a country's climate policy density (see Knill et al., 2012 for a corresponding discussion on regulatory policy outputs and impacts). In other words, we measure the existence of a policy within a category (density referring to its presence or absence), but we are unable to account for a policy's quality.

Primarily, we use the available data on climate policies in three ways when describing the legislative information in more detail and addressing our hypotheses in the next section. Firstly, we look at the coverage of any of the eight individual categories, i.e. whether a country enacted a policy in the respective category. Secondly, on an aggregated level, we consider the amount of categories addressed by national climate policies, i.e. in how many of the overall eight categories a country enacted policies. Thirdly, we examine the date of the first enacted policy within a category, i.e. how many years have passed since the first piece of national climate policy addressed a respective category.

During the course of the empirical analysis in the subsequent section, we investigate differences within the coverage across different groups of countries by considering EU membership, a country's income level as well as its environmental vulnerability as potential determinants of climate policies (see Section 2). Please note that this approach is not intended to provide a fully-specified model for a country's degree of CPI. The subdivision allows rather for indicating patterns of policy activity, and the number and type of categories may serve as an approximation for CPI. Summary statistics of the country characteristics, together with their definition and the source from which the data were extracted, are presented in alphabetical order in Table 1. Our focus on national climate policies from 1990 until 2016 results in the observation of 171 countries over 27 years, amounting to 4617 country-years (Fleig and Schmidt, 2018).[4]

4. Results

We begin our empirical analysis by looking at the coverage of the eight individual categories over the last 27 years. Fig. 1 shows for each category, separately, how many of the 171 countries enacted respective policies. Altogether, the eight graphs illustrate that the coverage grew (considerably) across all categories.

Besides this common trend, differences across categories are most noteworthy. First, the strongest growth since 1990 and highest coverage in 2016 can be observed for both energy categories as well as administrative arrangements. In contrast, we obtained the lowest values for carbon pricing and transportation. Secondly, the development occurred across categories at different points in time. After a slow start in the 1990s, regulations on administrative arrangements and energy moved forward to lead the steady increase in coverage, while policies on adaptation and R&D only became more prominent after 2005. This corresponds to previous contributions (Jordan and Halpin, 2006), which argue that policy integration processes move at different paces.

In addition, while growth patterns vary across categories, most curve progressions closely resemble the prominent S-shape of policy

[2] The *Climate Change Laws of the World* database (formerly known as GLOBE) is compiled by the Grantham Research Institute on Climate Change and the Environment together with the Sabin Center for Climate Change Law and can be accessed at www.lse.ac.uk/GranthamInstitute/climate-change-laws-of-the-world.

[3] The 'administrative arrangements' category contains policies which 'manage and support domestic responses to climate change and/or mainstreaming climate change management and financing; a good example is Bangladesh's 2009 Climate Change Trust Fund Act, which establishes a new institutional framework to fund adaptation activity' (Averchenkova et al., 2017: 3)

[4] Please note that our empirical analysis includes all available legislative information. However, as the overwhelming majority of national policies addressing climate change was enacted after 1990 (98.9%) and potential determinants are more feasibly obtainable since the 1990s, the subsequent discussion of dynamics and coverage is limited to this period.

Table 1
Summary statistics of explanatory variables.

Variable	Obs.	Mean	SD	Min	Max	Short description	Source
EU	4617	0.15	0.36	0	1	Indication of a country's membership in the European Union. As the *Climate Change Laws of the World* database covers all EU countries except for Malta and Luxembourg, our sample consists of 26 EU member states.	EU
EVI category	4617	3.18	1.09	1	5	A country's vulnerability group (ordinal classification) based on its EVI score: extremely vulnerable, highly vulnerable, vulnerable, at risk, resilient.	Kaly et al. (2004)
EVI score	4617	300.19	52.27	181	428	Aggregated measure across 50 sub-indices on the vulnerability of a country's environment to future shocks.	
GDP per capita	4,419	10,488.44	15,835.02	115.8	141,165.1	GDP per capita in constant 2010 US$. It comprises the sum of gross value added by all resident producers in the economy divided by mid-year population.	WDI
Income level	4617	2.64	1.04	1	4	Ordinal classification of income group level by the world bank: high income, upper-middle income, lower-middle income, low income.	WDI

Abbreviations: EVI - Environmental Vulnerability Index (http://www.vulnerabilityindex.net); WDI - World Development Indicators of the World Bank (databank.worldbank.org/data/download/site-content/CLASS.xls).

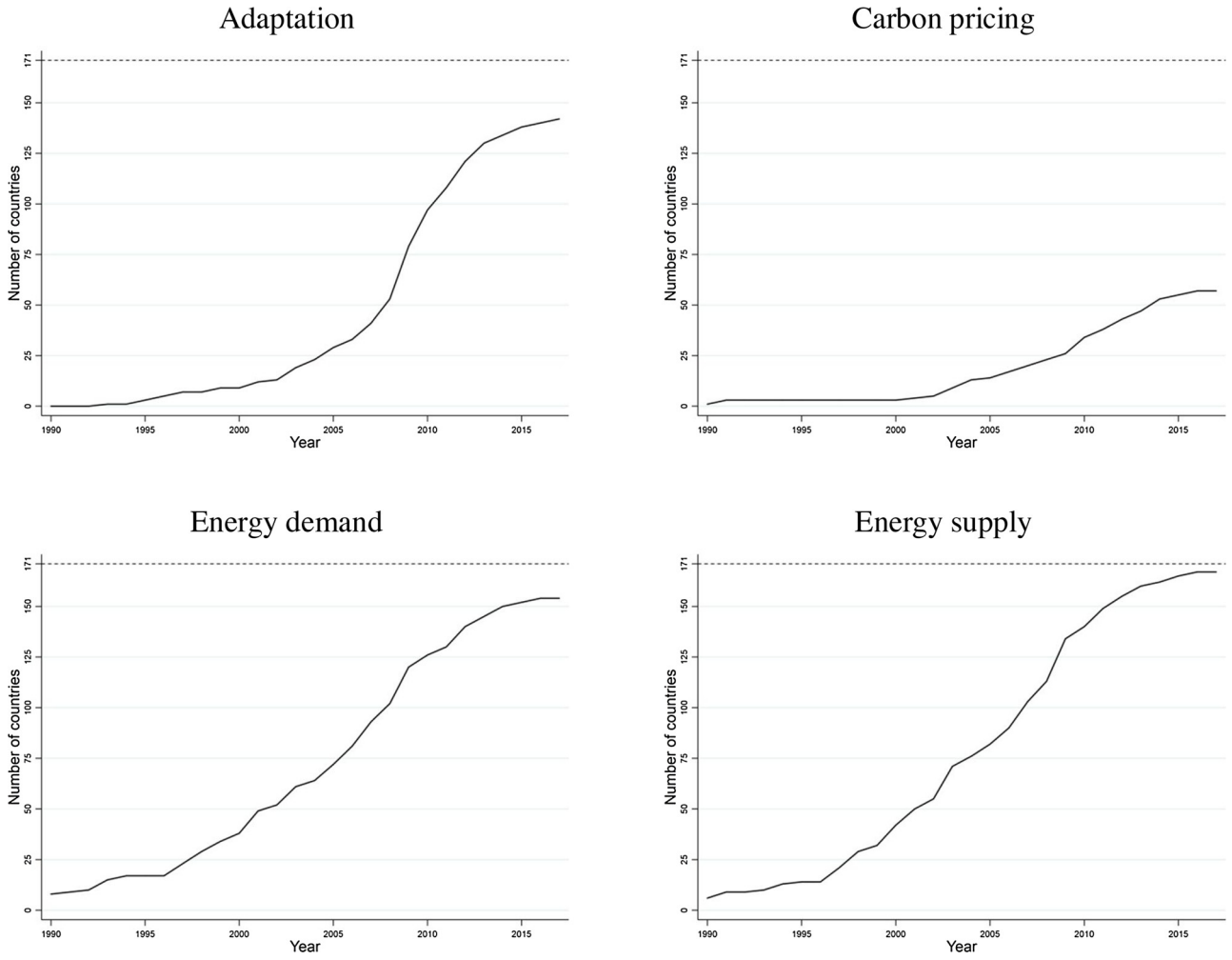

Fig. 1. The coverage of climate change categories over time.

adoption in diffusion studies (Jordan and Huitema, 2014; Massey et al., 2014). In particular, the late 1990s and early 2000s stand out as the first period of accelerating growth. This corresponds to previous findings on climate change legislation at large (Fankhauser et al., 2015), but, importantly, it is also observable at the individual category level.

Next, we turn towards the aggregated level. Table 2 shows the overall coverage by listing the average number of addressed categories across all 171 countries. In accordance with the individual category developments, we observe that since 1990 this rate has risen from 0.14 to 5.95. This significant expansion emphasizes the increasing importance of climate policies over the last decades from the perspective of individual category coverage.

Table 2 emphasizes yet another aspect. While the increase in category coverage over time is obvious, it becomes clear that the number of addressed categories varies considerably across countries (SD, range). In our next step, therefore, we address our hypotheses and look for potential drivers of the variance in coverage. This is accomplished with respect to two measures, namely the date when countries first regulated

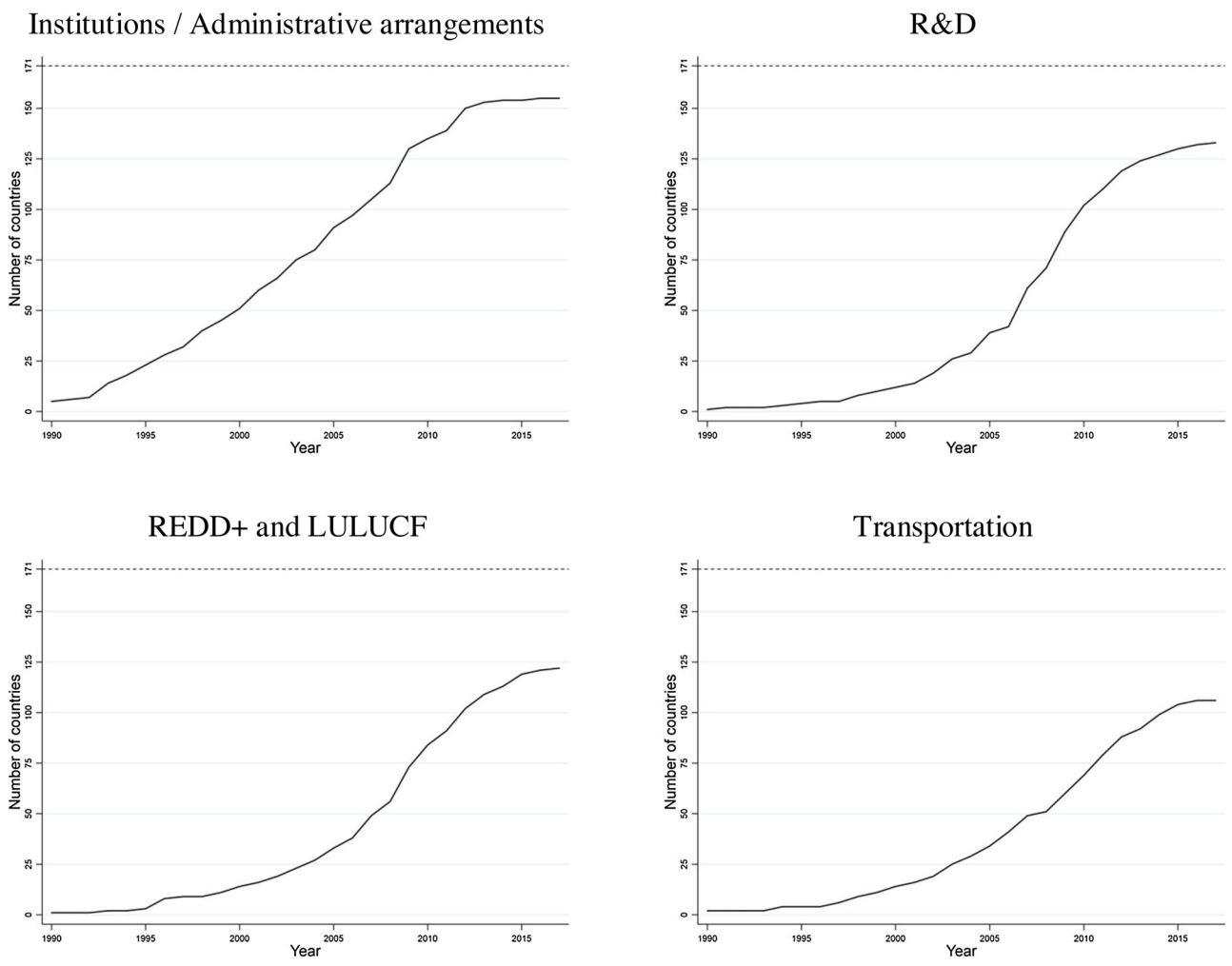

Fig. 1. (*continued*)

Table 2
The overall coverage of climate change categories over time.

Year	Mean	SD	Min	Max
1990	0.14	0.63	0	5
1995	0.42	1.02	0	5
2000	1.07	1.54	0	7
2005	2.30	2.19	0	8
2010	4.60	2.21	0	8
2015	5.95	1.74	1	8

Explanatory note: The table lists the average number out of max. 8 categories addressed by national climate policies across all 171 countries for the years 1990, 1995, 2000, 2005, 2010 and 2015.

a category and the amount of regulated categories throughout the observation period (see Section 3). We examine both aspects with respect to the previously discussed country characteristics (see Table 1). More specifically, we investigate whether countries that are members of the EU, possess a higher income level, or are more environmentally vulnerable enact climate policy earlier and/or in a more comprehensive way.

We first look at the date when countries first regulated a category and whether this is related to country characteristics. The respective measures are shown in Table 3. We observe that EU members took early action with respect to adaptation, carbon pricing, energy demand, REDD + and LULUCF and transportation. Thus, Hypothesis 1a is partly confirmed. Interestingly, we observe similar results for the measures of GDP per capita and environmental vulnerability. Countries averaging a higher income level or being more at risk started early with policies on carbon pricing, energy demand / supply and transportation (in the case of GDP also with administrative arrangements). Therefore, Hypotheses 2a and 3a are also partly confirmed.

Table 3
Effects of explanatory variables on the first policy within a category.

DV: date of first policy within a category	EU member	GDP per capita	EVI score
N	171	168	171
Adaptation	0.449 **	0.029	0.049
Carbon pricing	0.656 ***	0.292 ***	0.0141 **
Energy demand	0.522 **	0.268 ***	0.169 ***
Energy supply	0.351	0.146 ***	0.090 *
Administrative Arrangements	0.385	0.138 ***	0.080
R&D	0.386	0.078	0.081
REDD + and LULUCF	0.548 ***	0.067	0.014
Transportation	0.617 ***	0.263 ***	0.218 ***

Explanatory note: The tables list measures of association and corresponding significance levels for the date of first regulation of a category within a country and the explanatory variables. We use two different measures of association: For the nominal variable EU membership, we rely on Cramer's V. For metric levels of measurement as EVI score and GDP per capita, we use the Kendall rank correlation (Tau B), a non-parametric hypothesis test for statistical dependence (Agresti, 2010). Please note that correlations between explanatory variables themselves do not exceed a moderate relationship. The Bonferroni and continuity corrected significance levels are indicated as * = 0.1; ** = 0.05 and *** = 0.01.

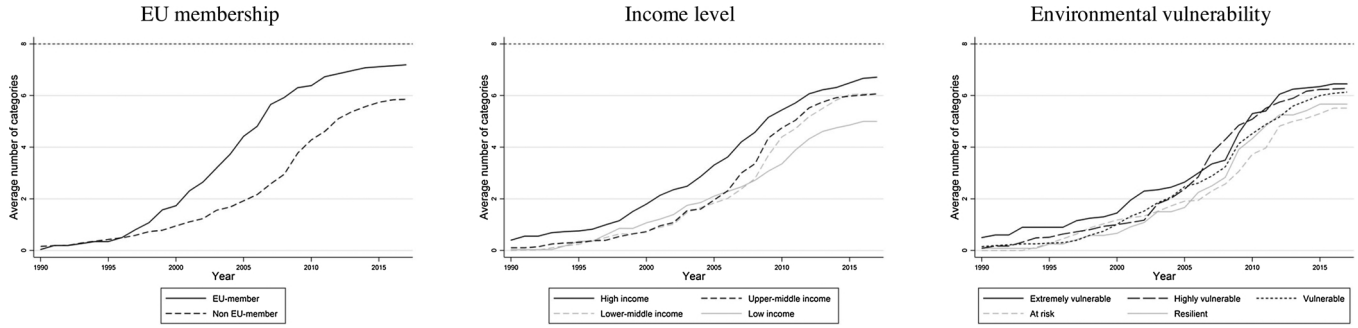

Fig. 2. The amount of climate change categories by country groups.
Explanatory note: The threes graphs show the average number of addressed climate change categories across all 171 countries separated by respective country characteristics. Source: own calculations based on *Climate Change Laws of the World* database.

Next, we look at the aggregated amount of regulated categories over the observation period and relate them to the discussed country characteristics. Corresponding overview graphs are shown in Fig. 2. In order to keep the graphs legible, we use ordinal categories for depicting the development with respect to income level, and environmental vulnerability (see Table 1).

In the left graph, we observe, as expected, that EU member states exhibit a higher rate of coverage. This becomes particularly pronounced at the end of the 1990s, while the gap visibly shrinks from the late-2000s onward as non-EU members 'catch-up'. The middle graph clarifies that the group of high-income countries stands out the most against low-income countries with the least comprehensive coverage. Upper- and lower-middle-income countries behave rather similarly. With respect to a country's environmental vulnerability, the right graph shows no strictly separate development across the groups over the entire observation period. Until the early 2000s, extremely vulnerable countries are most active. From 2005 onward, highly vulnerable countries show a steep increase while 'at risk' instead of 'resilient' countries exhibit the lowest number of addressed categories.

In addition to the visual inspection, Table 4 lists the corresponding test statistics with the developments just discussed. In order to use all available information, the measures are calculated based on metric values for income level, and environmental vulnerability instead of the ordinal categories used in Fig. 2.

With respect to EU membership, the results confirm the visual impression as test statistics are statistically significant from 2000 onward. This supports Hypothesis 1b for the last 17 years where EU member states show a higher number of addressed categories. Next, a larger GDP per capita is significantly associated with a higher number of addressed categories and corroborates Hypothesis 2b. As Fig. 2 shows, the group of high-income countries predominantly drives this development. For environmental vulnerability, we only observe until 1995 and from 2010 onwards an association to more climate policies. Thus, Hypothesis 3b is partly confirmed.

Finally, we can also have a look into which categories drive these differences. Fig. 3 shows for every category the share of countries within a specific group that enacted respective climate policies. While EU membership is associated with a higher share of countries passing respective policies throughout all categories, adaptation is least pronounced, while carbon pricing as well as transportation are most dominant. Looking at income levels, the domination of high-income countries is not manifested within adaptation measures. Also noteworthy is the high share of lower-middle-income countries with regulation concerning administrative arrangements, R&D and REDD+ and LULUCF. For environmental vulnerability, we observe similar values over time for all risk categories in case of adaptation, energy supply and REDD+ and LULUCF. Carbon pricing and energy demand show a clear pattern of more activity in relation to vulnerability, while also the high share of resilient countries with R&D policies is quite noticeable.

Table 4
Effects of explanatory variables on the amount of categories addressed by national climate policy.

DV: amount of categories addressed by national climate policy	EU member	GDP per capita	EVI score
N	171	168	171
1990	0.083	0.214 ***	0.137 **
1995	0.187	0.168 ***	0.154 **
2000	0.307 **	0.174 ***	0.008
2005	0.467 ***	0.164 ***	0.057
2010	0.433 ***	0.209 ***	0.175 ***
2015	0.333***	0.249***	0.159***

Explanatory note: The tables list measures of association and corresponding significance levels for the amount of categories addressed by national climate policy and explanatory variables. We use two different measures of association: For the nominal variable EU membership, we rely on Cramer's V. For metric levels of measurement as EVI score and GDP per capita we use the Kendall rank correlation (Tau B), a non-parametric hypothesis test for statistical dependence (Agresti, 2010). As most policies are passed after 2000, empirical findings for 1990 and 1995 are based on rather few laws and should, therefore, be treated with caution. Bonferroni and continuity corrected significance levels are indicated as * = 0.1; ** = 0.05 and *** = 0.01.

5. Discussion and concluding remarks

Climate policies and politics have evolved significantly since the early 1990s, yet our understanding of this evolution has been rather meager. In this paper, we provide a comprehensive assessment of global patterns of national climate policies over the last 27 years and across 171 countries. Overall, our results clearly substantiate a considerable increase in numbers of categories addressing climate policies.

Taking a closer look at our findings, we contribute to the state of research in three ways. First, we find that EU membership, a countries' income level as well as its environmental vulnerability are each associated with a more comprehensive coverage, i.e. more addressed categories. The results are most pronounced for EU membership, which also relates to earlier action on climate policy, and economies with a high GDP per capita. Second, within our sample we observe that the following categories of 'energy supply' and 'energy demand' as well as 'administrative arrangements' are addressed most frequently throughout our observation period. In contrast, less commonly addressed categories are carbon pricing and transportation. Thus, the results of our cross-country analysis over time highlight the importance of multi-sector policy approaches towards the challenges of climate change (Christopoulos et al., 2012) but may also serve as indication for future climate action. On the one hand, it is reasonable to assume that countries not having enacted regulations in the most commonly addressed categories will soon follow suit. On the other hand, transportation and carbon pricing, specifically, are policy areas that are least

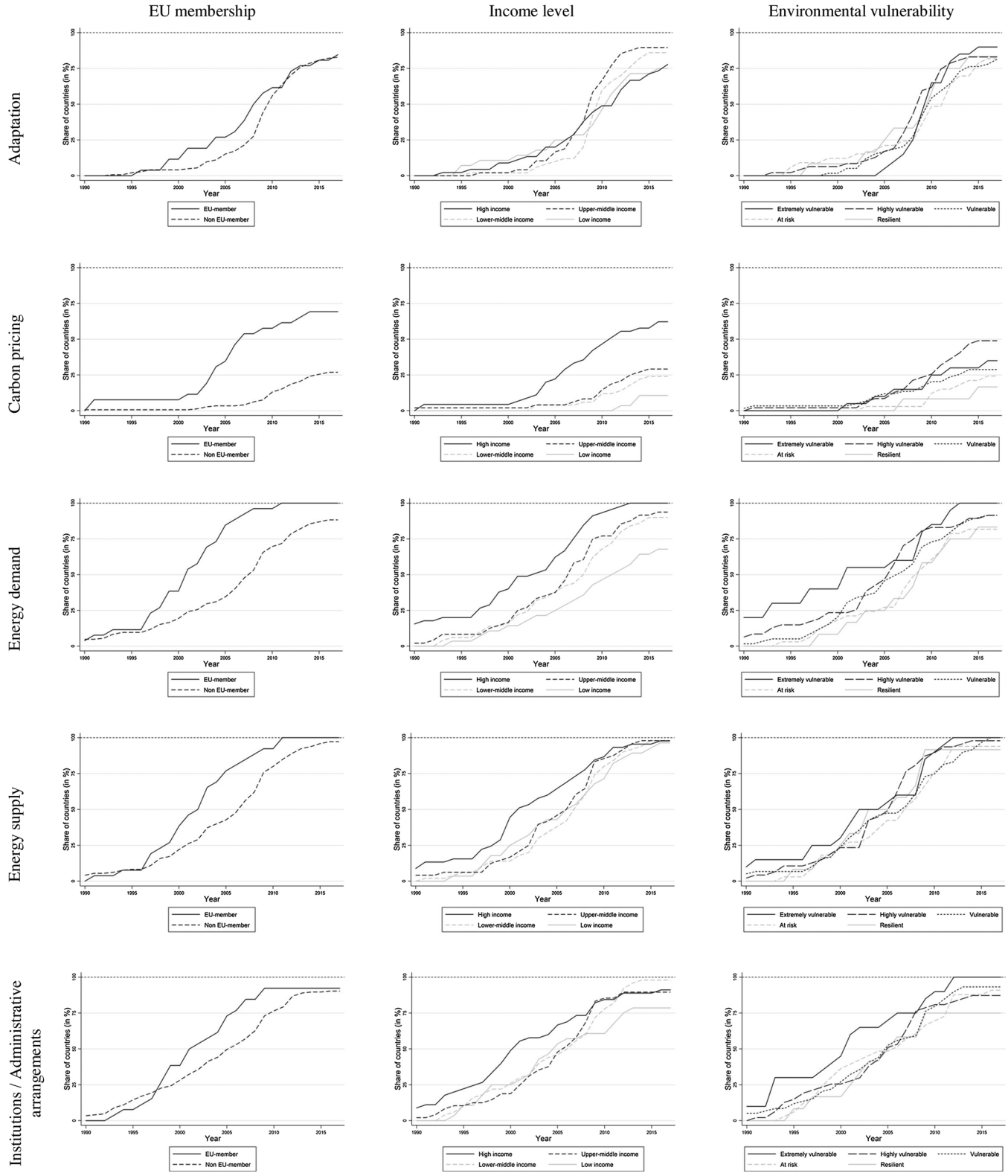

Fig. 3. The coverage of climate change categories by country groups.
Explanatory note: The graphs depict the share of countries within a specific group that enacted a policy in a respective category. Source: own calculations based on *Climate Change Laws of the World* database.

addressed and represent an area where much is yet to be uncovered.

Third, the varying degrees of category coverage offer further insights. The time-series cross-country character of our analysis complements existing literature resting prominently on small-n case-study designs focusing on the EU (Fleig et al., 2017), Annex II (Tobin, 2017) or OECD countries (Jacob et al., 2008). While we lack qualitative information and the circumstances under which policies were enacted, we can assess that within our sample, policies in both 'energy' categories are most pronounced. Hence, our findings suggest that efforts at CPI were more common with respect to the energy domain than

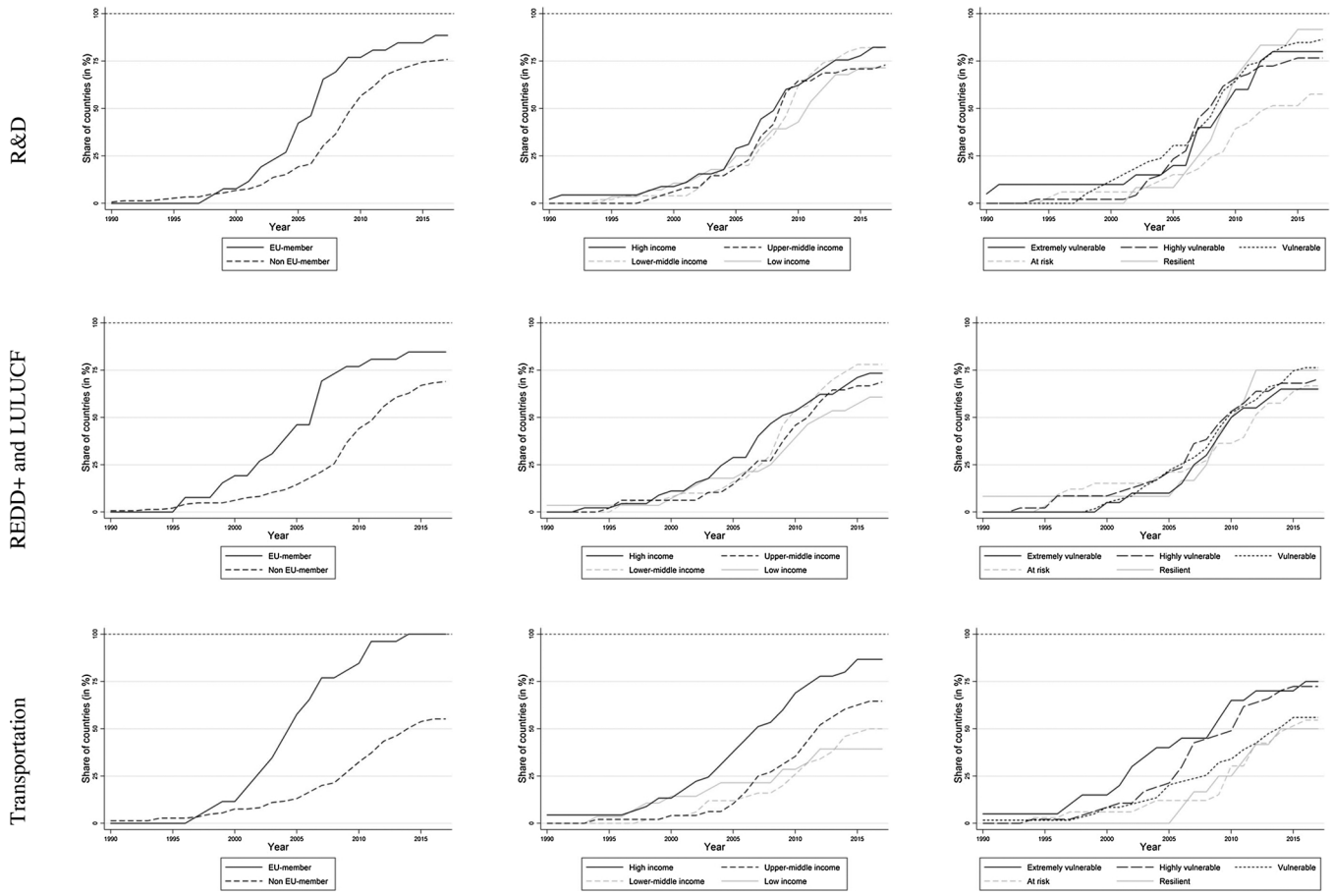

Fig. 3. (*continued*)

towards transportation. With respect to climate specific categories, i.e. no efforts at CPI, 'administrative arrangements' were in the focus of these efforts in comparison to the low numbers of policies addressing carbon pricing.

While we believe that these are important insights, we acknowledge that our findings only constitute a first step towards further assessments. In addition, we address several shortcoming of this study. Empirically, the first and most evident drawback is that our dataset is restricted by the coding format of the *Climate Change Laws of the World* database. For example, rather than treating adaptation as a single unit, we believe that policies included in this category certainly extend across multiple domains. This provides an opportunity for future studies to uncover whether this umbrella term conceals important sectors such as agriculture. At the same time, further distinctive classifications might ultimately allow for comparative assessment of regulatory policy outputs with their respective impacts (for example setting the amount of emitted greenhouse gases against the overtime enacted number of climate policies; see for the case of Austria, Niedertscheider et al., 2018).

Second, while our investigation of external factors serves well as onset, future studies should definitely extend the set of explanatory variables towards political conditions, such as level of democracy; institutional capacity, such as economic importance of the agricultural sector; or problem characteristics, such as population density (Christoff and Eckersley, 2011). However, it is important to note that every comparably large sample will face difficulties in compiling the respective amount of information. Therefore, we also encourage the exploration of such factors in selected groups of countries.

Third, obtaining qualitative information on country cases would allow us to infer whether and, if so, which mechanisms enable integration of climate policies across countries and particular categories. Future studies, for example, by means of process tracing, would be well suited for determining whether and, if so, which diffusion mechanisms (i.e. learning, emulation and competition) drive the spread of policies across countries and categories (Croissant and Tosun, 2016; Jordan and Huitema, 2014; Maggetti and Gilardi, 2016). Future research should also look at actor constellations, or might assess the potential influence of external events (i.e. timing aspects) on progressing integration, such as the Kyoto Protocol adopted in 1997, or the Conferences of the Parties (COPs) as they are usually accompanied by public attention. Lastly, the analysis would benefit from including policies enacted at the subnational level.

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